Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

PUBLIC HEALTH REPORTS

VOL. 37 JANUARY 27, 1922 No. 4

SURGICAL TECHNIQUE EMPLOYED AT UNITED STATES PUBLIC HEALTH SERVICE HOSPITAL NO. 35.

The descriptive material presented in this report is an attempt to portray the actual practice and the exact status of the operating room technique. This purpose of presentation was maintained throughout the collection of subject matter, the investigation of details, and the final checking up of results. There must necessarily be so many and such varied points of detail that any picture that we may develop is at best only a snapshot of a moving object during its stages of growth. This has made it imperative to systematize the order of our presentation. In so far as we have been able to do this, the account of the operating room technique at this hospital will follow this general outline:

1. Cleaning the operating room.
2. Care of operating room supplies.
3. Sterilization.
4. The dressing room.
5. The wash room.
6. Preparation of the patient.
7. Preparation of the operating room.
8. Division of labor and cooperation among personnel.

1. Cleaning the Operating Room.

The floor of the operating room is mopped daily by the orderlies with a 5 per cent creolin solution. This antiseptic cleaning of the floor is very frequently extended to the lower portion of the side walls, which are marble, the interior woodwork, and such operating room equipment as basin-stands, tables, etc. At intervals, as deemed necessary, the entire interior and equipment are subjected to a more thorough and painstaking cleaning with brush, soap, and water. Glass and metal fixtures about the operating room are cleaned with a scouring compound.

After an operation, the "clean up" method employed is as follows: All soiled linen, used sponges, waste material, etc., are removed; stock solution bottles, anesthetizing outfit, hypodermic tray, tables, etc., are moved back to their proper places; instruments are collected in a basin and taken to the sink in the wash room, where they are washed, scoured with a scouring compound, and wiped dry; basins, pans, and glassware are washed with green soap and water and dried. Alcohol, oxalic acid, and ether are used to remove stains that resist the ordinary cleaning method.

2. Care of Operating Room Supplies.

The instruments and operating room equipment are essentially as great a care as comes within the realm of a nurse's activities. The order and arrangement of things constitutes an important link in the continuous chain of our technique. Accessibility, in order of placement, is a prime consideration. Instruments that are used constantly, and at times must be had quickly, are put on the handiest shelf in the most readily available place. Other instruments and appliances, like cautery sets, Albee bone sets, etc., which are infrequently used, are placed on lower shelves, where the utility of space and not the speed of availability becomes the objective. Grouping of similar instruments and other "tricks of technique," depending upon the initiative of the personnel involved, have sometimes added greatly to the success of this phase of the work. However, the system developed at this institution can best be described by diagram, and the plan of the instrument room, with the shelving arrangement, is presented with this purpose in view (Fig. 1).

Within certain limits our scheme of availability is extended and employed in the cupboard for linen and the closets for basins, pans, etc. The principle of having things conveniently accessible at a moment's notice has become a doctrine that we are endeavoring to weave into all phases of our technique. In the part of this paper that deals with the actual preparation of the operating theater, the import of this will be more readily observable in detail.

The almost daily handling of instruments and operating room equipment in "setting up" and "putting away" is an indispensable inventorial aid to the preparation of requisitions. A close scrutiny of all instruments, utensils, etc., is very necessary, both from the standpoint of economy in preservation and of usefulness in operation. The nurse who assumes this responsibility must inspect for surgical knives that need sharpening, for instruments that have become tarnished or rusted, and for the detection of missing parts, chipped enamelware, deteriorated rubber tubing, cracked glassware, or other condition of materials that would likely cause an operative accident or an interruption in technique.

3. Sterilization.

The sterilizing is done in a steam sterilizer autoclave. All supplies that are sterilized in the steam autoclave compartment are left in under 20 pounds pressure for one hour, at the end of which time the steam is turned off and they are allowed to dry in the hot air for another hour. In the instrument and utensil sterilizers all articles are subjected to 20 minutes of actual boiling before they are considered sterile.

The instrument and utensil sterilizers are, as a rule, wiped out after each day's use, and the entire sterilization system may be cleansed more thoroughly as often as necessary. The plumbing connections are overhauled once every week by the chief engineer, to forestall any developing defect.

In connection with the operating room at this hospital, two complete sterilizing systems are available for use. This is not only advantageous because large quantities of goods can be sterilized, but it also insures uninterrupted sterilizing; in case one system breaks down, the sterilizing can be immediately transferred to the other.

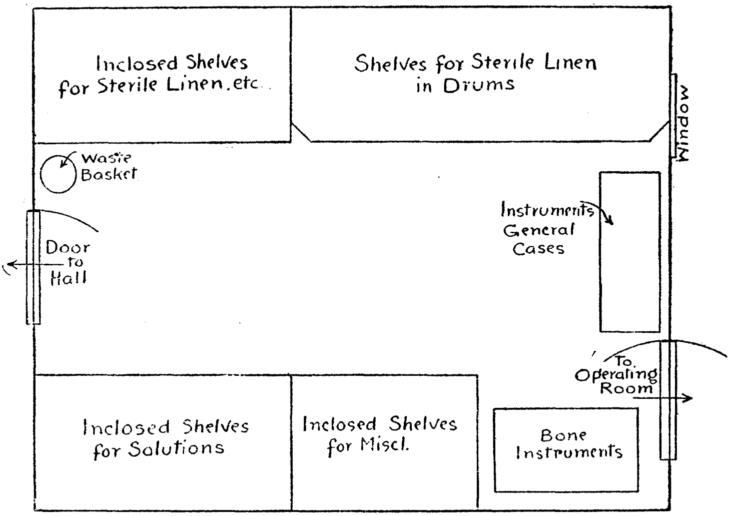
Inclosed Shelves for Sterile Linen, etc.
Shelves for Sterile Linen in Drums
Window
Waste Basket
Instruments General Cases
Door to Hall
To Operating Room
Inclosed Shelves for Solutions
Inclosed Shelves for Miscl.
Bone Instruments

FIG. 1 - INSTRUMENT ROOM (Sterile Linen, etc.)

The quantitative bulk of supplies (for the most part linens) used in the operating room is sterilized in the autoclave compartment. The separate sterilizing drum containers are used for grouping and sterilizing together such supplies as will likely be needed for operation. The drums are usually prepared the day before the operation, as follows: First, a towel is spread out on the bottom of the drum and arranged about the sides of the drum so that none of the supplies within will come in contact with the sides. Then the drum is packed, so that the articles wanted first in "setting up" will come on top of the drum. Another towel is placed over the top, and the drum is then ready for sterilization. The drum containers are in vogue at this hospital in preference to the package method commonly used for small supplies at other hospitals. For larger articles (gowns, sheets, and, sometimes, sponges) the package method is also used. The advantages and disadvantages of the drum method of preparing supplies for sterilization are worth considering in connection with our technique and are here set forth as proof of our practice. In transferring supplies from the dressing room to the sterilizer and then to the operating room, the drums are more easily handled. Supplies packed in drums are, by the nature of their containers, less likely to be contaminated. On the other hand, the side slides on drums must be opened carefully before putting them into the autoclave or else the penetration of the steam into their contents is not sufficient. Also, when a drum is once opened, all articles not actually used must be resterilized before they can be used again. Although there is here a slight advantage of economy in the package method, this is certainly equalized by the time wasted in the preparation of individual packages. We have found by experience that a utilization of the advantages of both of these methods brings a happy medium of results. A sterilizer control tube is placed in the center of all large packages and drums to indicate the success of sterilization, and a drum is discarded when the tube is not melted.

The majority of operating-room instruments and small receptacles, such as small basins, medicine glasses, etc., are sterilized by boiling water in the instrument compartment. Larger articles, such as basins, long pans, etc., are boiled in the utensil compartment. Instruments, small glasses, syringes, etc., are wrapped in towels to keep them together so that after sterilization they will not be directly touched until actually needed.

Knives, scissors, large glass syringes, tubes of catgut, and instruments likely to be ruined by subjection to intense heat, are sterilized by being placed in pure carbolic acid for at least 20 minutes or until they are needed. Just before being used they are transferred to a 95 per cent alcohol solution by means of sterile forceps. They are then immersed in sterile water and arranged on the sterile table or given to the operator.

4. The Dressing Room.

Most of the operations are done in the morning, the afternoon being left free for the performance of odds and ends of work and for the preparation of dressing room supplies for future operations. Drums are packed, operating sheets, gowns, and other linen supplies are folded and done up in packages in readiness for sterilization. Twelve by twelve lap sponges are folded in four layers and wrapped up six to a package. Four by four mop sponges are folded and placed in packages of 24. The linen is put away, torn or unserviceable articles are turned in, and only enough is prepared to meet the operating room demands.

Preparation and sterilization of rubber gloves.—After use, gloves are thoroughly washed in green soap and water, rinsed out, and then placed in the instrument compartment of the sterilizer for 15 minutes of boiling. After boiling they are turned inside out and hung up until completely dried. The dry gloves are taken to the dressing room, where they are inspected for punctures or tears. If any holes are found, they are mended with rubber patches. As a rule mended gloves are not given to the operators or the sterile nurse, but are reserved for use in the clinic or some other place where the demands of sterility are not so great. The perfect gloves are sorted out, powdered on the inside, wrapped separately in gauze, and made up in packages or placed in glove case, and sterilized again with the linen supplies. Although gloves are sterilized with other linen supplies, they are not placed in the drums where their subjection to intense steam pressure can not be assured. It will be seen that there is an advantage in this method of preparing gloves, as it involves the double sterilization plan, water and steam, meets the demands of the authorities on such questions of technique, and satisfies the surgeon who prefers to use dry powdered gloves.

5. The Wash Room.

Another phase of our technique which we consider important is the provision made for the personal cleanliness of all persons working in the operating room. We have, in this connection, a separate wash room for the surgeons, and the care of this wash room is given over to the nonsterile nurse. This care consists in rigid watchfulness as to the thoroughness of the general cleaning and the most scientific arrangement for the best possible method of individual sterilization. The nurse so intrusted must keep on hand an adequate supply of nail files, small scrubbing brushes, sterile sponges, green soap, and such operating suits, caps, and gowns as it may be the personal preference of the surgeon to wear. The green soap is prepared as follows: Equal parts of tincture of green soap and water, boiled for 1 hour, to 1 gallon of which is added 250 c. c. of alcohol.

No standard in regard to the time of scrubbing is employed by all the personnel, but this is left to the sense of responsibility they have developed as a result of their individual training. However, the time of scrubbing, without exception, falls within a minimum limit of

5 minutes and a maximum limit of 15. The steps for hand sterilization usually followed are:

1. Hand scrubbing with brush, green soap, and water. Time: 5 to 15 minutes. Sponge with green soap, and water.
2. A nail file is used during scrubbing time.
3. Dipping in antiseptic solutions:
    - (*a*) ½ per cent creolin solution. Time: Varies according to training, but at least 3 minutes.
    - (*b*) 50 per cent alcohol. Time: Varies according to training.

(Hands are allowed to dry in air; a towel is never used.)

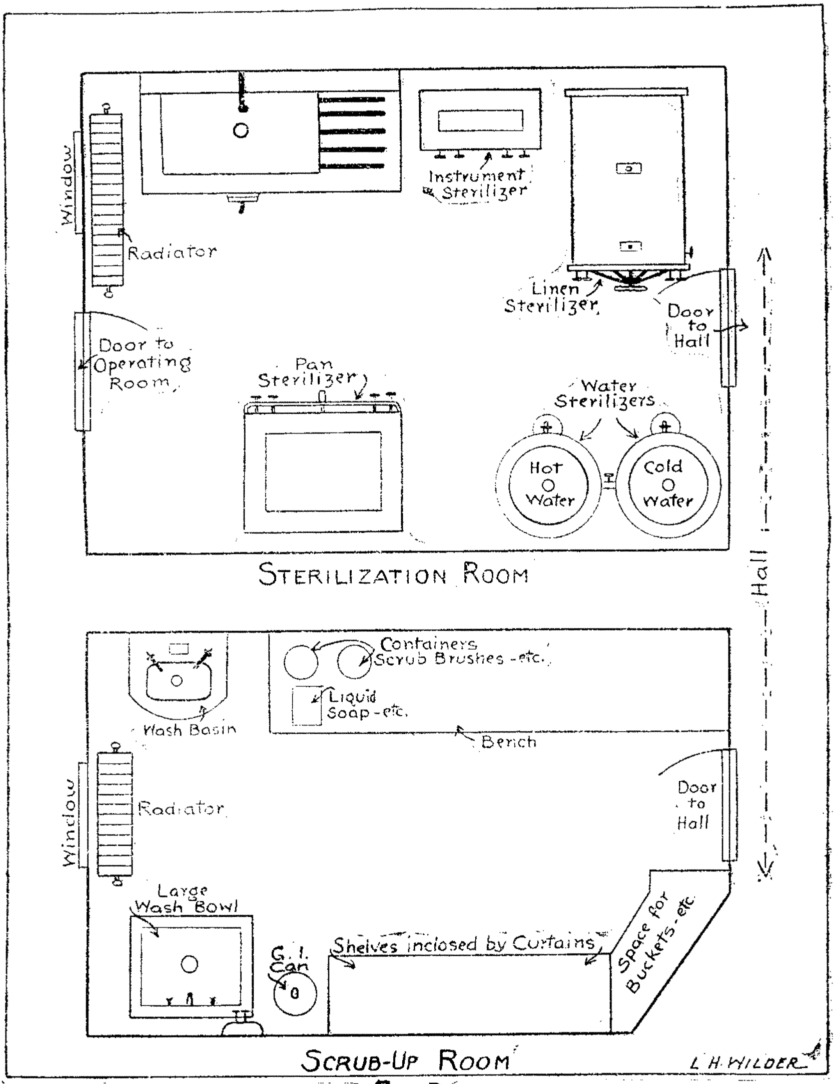

FIG. 2

At the completion of this process we consider the hands and arms in condition to put on sterile rubber gloves.

The diagram of the wash room (Fig. 2) indicates the water supply, the position of faucets, and the arrangement of articles used in scrubbing up. All surgeons and nurses who expect to be present at the operation, and of whom surgical sterility is required, are allowed the use of this wash room.

From time to time doctors visit the operating room, but the operating theater provides nothing in the way of a spectators' section, and we have had to develop expedients to meet this condition. During an operation it becomes the duty of the nonsterile nurse to keep vigilant track of the coming and going of all persons; her immediate endeavor is to cap and gown all new arrivals. It might well be said here that our technique is occasionally threatened by two classes of unscrupulous people—some, in the undeveloped nature of their mentality, fail to grasp the meaning of sterility; others, by "dint of their genius," feel themselves superior to the common rules of the operating room. The first class can be dealt with directly and accordingly; the other, often involving prominent professionals, obtuse to educational hints, must be handled with kid gloves.

6. Preparation of the Patient.

The complete operating room pavilion provides a comfortable ward accommodation for 13 patients. The patients are transferred to the operating room ward the night before operation and are kept there after operation until their condition warrants the exposure attending a return to the convalescent surgical ward. In the operating room ward the patients are given a final examination and such medical treatment as will prepare them for a successful operation.

The field of operation is shaved the night before by the night orderly. The area is then washed with green soap and water, and alcohol (70 per cent) is applied. Finally, an alcohol pack is put on and held in place by a sterile compress. Immediately prior to operation the compress is removed by a nonsterile assistant, and the area is again antisepticized by a sterile assistant (nurse or assisting surgeon) with alcohol and ether and then painted with iodine. The draping of the patient with sterile towels and sheets completes the preparation of the patient for operation.

7. Preparation of the Operating Room.

The most important part of the operating room technique, at least as far as the nurses are concerned, is the "setting up," or the convenient and scientific arrangement of things for the operation. All preceding explanatory paragraphs in this paper have been devoted to information that would tend to clarify and lead up to this important process, and, in fact, all of our work is considered secondary to this phase of our technique which deals so intimately with the operation itself. The technique employed here is progressively explained and the successive steps should be followed throughout by constant reference to the appended drawing (fig. 3) of the operating room interior. Although a progressive presentation by stages is attempted, it must be admitted that, as the preparation is performed by various members of the personnel, it can not follow an exact and invariable outline. However,

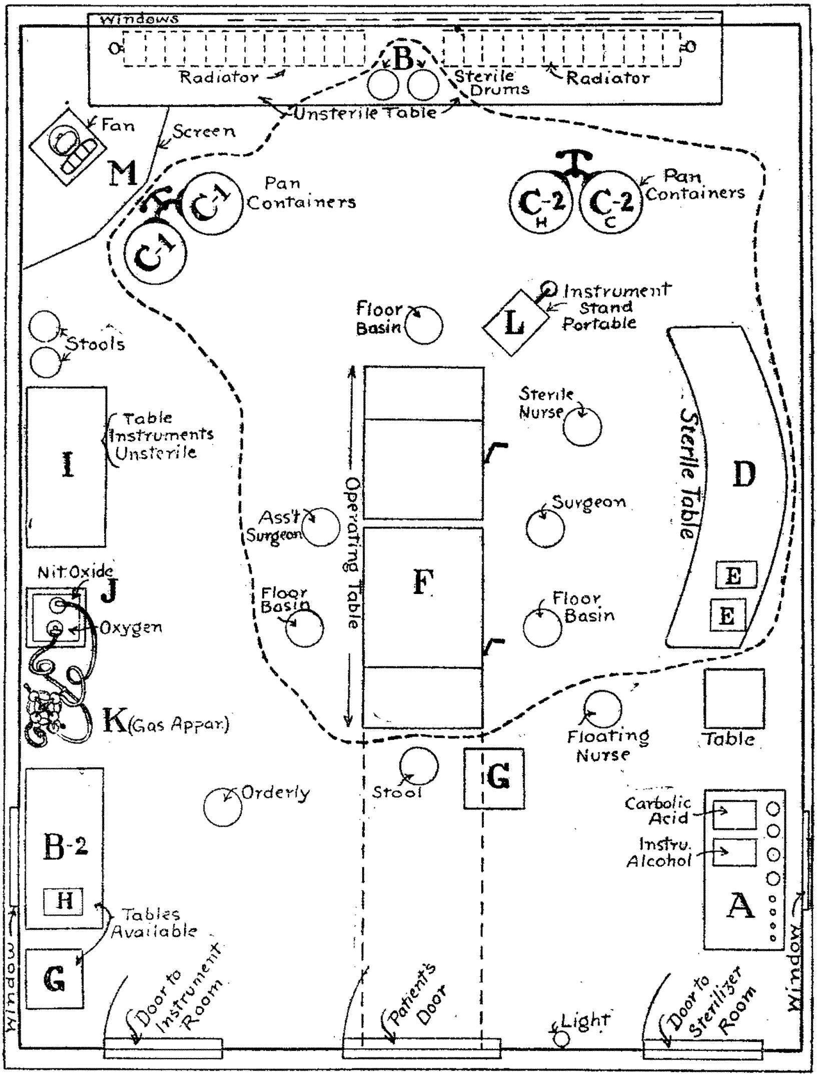

Fig. 3 - Operating Room

the central scheme to accompany the nurses (assisted by the orderlies) through a day of operating room work is not deviated from to any great extent.

The day nurses arrive on the ward for duty at 7 a. m. The cabinets and instrument cases are opened, and the steam is turned on in the sterilizers. Table "A," unsterile, which can be conveniently named a service table, is usually set up first. Gallon supply bottles of the following solutions are set out: 95 per cent alcohol, instrument alcohol ("used" 95 per cent mixed with carbolic), and creolin solution. On this table are usually kept cotton applicators, a small bottle of iodine, and a can of used ether for the final preparation of the skin for operation. Gauze for the post-operative dressing is also kept on this table. On the corner of table "A" two instrument pans (unsterile) are placed as indicated in the diagram; the pan nearest the sterile instrument table is filled with pure carbolic acid, and the other with 95 per cent instrument alcohol. In the pure carbolic acid pan are placed sharp-edged instruments, glass syringes, suture tubes, and other articles that require this method of sterilization. All things to be thus sterilized are placed in the pure carbolic acid at the same time the other instruments and supplies are put in the water or steam sterilizers. This insures at least a 20 minutes' bath in the antiseptic. At the end of this time, or whenever they are needed, they are lifted out of the carbolic by means of sterile forceps and transferred to the instrument pan containing the 95 per cent alcohol. After they have been thoroughly washed in the alcohol, they are removed to the sterile water pan on table "D" and given a cool, sterile water immersion. After this they are ready for use and are placed in position on the instrument table or given directly to the operator.

While table "A" is being set up by one nurse, another nurse (as a rule, the sterile nurse, before she scrubs up) places all articles to be sterilized for the day's operations in the instrument and utensil compartment of the steam sterilizer. These materials for sterilization are divided between the two compartments, instrument and utensil, as may be convenient, according to their size and nature. In the utensil compartment are placed the following articles: 6 white granite solution pans, 2 large white granite pitchers, 2 emesis basins, four large square pans, etc. In the instrument compartment are placed the following articles: 4 two-ounce medicine glasses, several medicine droppers, and the instruments to be used during the operation. It is to be noted here that during this time when the instruments, etc., are selected and the sterilizers are filled, this phase of the work not only involves the automatic action of the nurses in "placing things," but, more important, it incorporates the play of visual and deep receptors; that is, during this time the sterile nurse has ample opportunity for foresight in the proper selection and the final critical checking-up observation of the materials to be used.

The drum containers and packages of sterile linen are brought out from the cupboards and placed on the unsterile shelf over the radiators, marked "N" in the diagram, by "floating" nurses. Other secondary and minor arrangements, somewhat dependent upon the character of the day's operations, include the placing or adjustment of unsterile supplies and equipment.

The nurses usually go to breakfast at this time, 7.30 a. m. When they return, approximately one-half hour later, the instruments, etc., are sufficiently sterilized (20 minutes being the minimum time required in our practice) for their removal to the scene of operation.

From this time on, a division of labor takes place which separates the preparatory operating room technique into the duties of the sterile and nonsterile nurse. The designated sterile nurse now scrubs up according to the general method described in the former section of this report. The nonsterile nurse drapes the basin stands, "C," with sterile linen and places in the basin holders two of the large white enamel basins from the utensil sterilizer, filling them, respectively, with one-half per cent creolin solution and 60 per cent alcohol solution. She now opens the drum containers and some of the sterile packages of towels, sheets, sponges, etc., thus making all such supplies available to the sterile nurse. The sterile nurse, who is by this time "scrubbed up," soaks her hands in the above solutions of creolin and alcohol and proceeds to drape the long instrument table, "D," and the portable table, "L," with sterile towels and sheets. The articles from the instrument and utensil sterilizers are now brought out and arranged in their places as follows: Two white granite solution-pans (on stand marked "C-2" on diagram) for the hot and cold sterile water; two emesis basis, placed on table "D" as indicated; two of the large square pans are placed on the end of table "D," to be used as instrument or suture-tube receptacles. Articles remaining are left in the sterilizer for any emergency or later demand that may occur.

The way instruments are placed in the sterilizer determines the order in which they are to be removed to the operating room. How the instruments are placed in the sterilizer is determined for the most part by the character of the operation. For instance, if the operation is a bone operation, which necessarily presupposes the use of a large number of heavy instruments, the instruments are placed directly on the bottom tray of the sterilizer and removed to the operating room by lifting out and carrying the entire tray to the scene of operation. Again, if only a few small instruments are to be used, they may simply be wrapped in a towel, which is picked up with sterile forceps and transferred to a sterile pan, and the pan is taken to the operating room within reach of the sterile nurse, who arranges the instruments on the sterile table "D."

When everything necessary for the operation has been brought from the sterilizer, the sterile nurse occupies herself with arranging these articles on tables "D" and "L" in the most convenient way possible. The general method of arrangement has been indicated as far as possible on the diagram, although it can readily be understood how this particular method may be varied within wide limits. The general principle governing the arrangement of instruments is one of convenience and quick utilization. The details of this technique adjust themselves to the personnel involved and the determining characteristics of the operation. The preparation of sutures and a last critical survey of the ensemble complete the duties of the sterile nurse until the actual arrival of the patient.

In the interim before the arrival of the patient, the nonsterile nurse is kept busy with the performance of many secondary but nevertheless important duties. The ether anesthetic table, whether the operation is to be under local or general, must be prepared. On this table are placed the following articles: Ether, ether masks, tongue forceps, trachea tube, mouth gag, folded towels (wet and dry), jar of vaseline, small cotton pledgets for covering the patient's eyes, and patient's cap. Ether cans are prepared by running a safety pin through the soft metal top, and the ether is given by the drop method. The table thus prepared is indicated in Figure 3 as "G." When local anesthetic is to be given, or general is not needed for any other reason, the table is kept in the position indicated in the diagram. However, when a general anesthetic is to be used, it is moved to the position indicated by the dotted line, i. e., to the right-hand side of the anesthetist, who is at the head of the operating table.

Local anesthesia is used in about 70 per cent of the cases operated upon at this hospital, and the proper preparation of the solutions is of considerable importance. The cotton stoppers of the bottles containing the solutions are covered with a gauze sponge, held in place by a rubber band placed around the neck of the bottle. The solutions used are freshly prepared and boiled each time a local anesthetic is used in major operations.

The operating room is equipped with two large tanks of oxygen and nitrous oxide (1,280 gallons each), and another apparatus with smaller tubes of the same gases for emergency. The anesthetizing apparatus is indicated in Figure 3 as "J" and "I." It must be frequently tested by the surgeon (or the nurse, if she understands) to determine the amount of gas on hand and the workable condition of the apparatus. In case it is asked for during an operation, it usually becomes the duty of the nurse to bring it into position and to connect the electric wall plug for warming the gas.

Table "I" in the diagram is an unsterile table which is utilized for a miscellaneous assortment of articles that are needed or may be needed during the operation. Among these are found tongue depressors, adhesive tape, bandage rolls, etc.

A hypodermic tray, "H," is prepared and placed on the unsterile service table, "B." The tray is made up as follows: One large spoon, alcohol lamp, sterile water, covered jar containing cotton, pledgets, 2 medicine glasses partially filled with alcohol (hypodermic needles are kept in one and hypodermic syringe in. the other), and the different tubes of hypodermic tablets that will likely be needed.

The operating room air is kept in circulation by a fan placed behind the screen "M" in the right corner of the operating room. The fan keeps the air alive, while the screen diffuses the flow and prevents the creation of direct air currents.

This practically completes the description dealing with the preparation of the operating room prior to the arrival of the patient. Variations of routine technique that may occur as the result of unstandardized and perhaps insignificant phases of the work, will be briefly commented on in the final section of this paper.

When the patient is brought in, the nonsterile nurse, who should be informed as to the character of the operation, takes charge of placing the patient in the required position, the arrangement of unsterile coverings and the adjustment of pillows, sandbags, or other props. She then removes the alcohol pack, and the surgeon's assistant applies the solution for final sterilization of the skin, as previously described. The sterile nurse (or the assistant) then drapes the patient and the table with sterile linen.

8. Division of Labor and Cooperation Among Personnel.

With the beginning of the operation the period of preparation ends and the duties of the sterile and nonsterile nurse depend upon the progress of the operation. The duties a nonsterile nurse may be called upon to perform during operation are not specific and, depending as they do upon the development of unanticipated wants, must be spoken of in a general way.

Just before the actual operation begins, the basins on "C-2" stand are filled with cold and hot sterile water, and the shallow pan on table "D" is filled with cold sterile water. During the operation the nonsterile nurse may be called upon to change the water because of contamination or merely as a precautionary measure.

Soiled linen, contaminated material, sponges, and instruments dropped on the floor must be removed by the nonsterile nurse or, by her direction, by the orderly. In this connection a constant watch should be kept by her as to the preservation of sterility and the uninterrupted progress of the operation. This, when thus briefly stated, does not seem to imply much: but in reality, through her neglect or inability to perform this function, disaster may occur With the concentration of the surgeons and the sterile nurse upon the performance of the operation, the general supervision of the smooth running of things naturally falls to the nonsterile nurse. Her ability and enthusiasm to act in this capacity gauge her success as an operating room nurse. Other calls for emergency may develop; the patient may "go bad," as they say, and his condition call for stimulant by hypodermic or subcutaneous saline injection. In this case it is the nonsterile nurse who prepares and administers the medication.

There has been continual reference throughout this paper to the phases of work participated in by the sterile nurse. However, for the sake of clarity, her duties may be briefly summarized as follows: She selects all instruments, catgut, needles, and other material likely to be used in the operation; she inspects and groups the instruments and oversees their complete sterilization; because her work during the operation requires a position in the midst of the sterile field, she scrubs up with the same thoroughness as the surgeon; when she is completely sterile she sets up the sterile tables and arranges the materials as they will be needed; when the chief surgeon and his assistants arrive, she assists them in putting on their gloves; during the operation her attention is directed solely to obeying the demands of the operators. She is also expected to keep a numerical account of the sponges and instruments used, to prevent the possibility of any being left where they should not be. The technique of the sterile nurse during operation should not consist of mere mechanical effort, but of a prompt obedience accelerated by intelligent anticipation. Her actual duties vary, as do those of the operators, according to the nature of the operation. Her technique, such as the handling of instruments, the preparation and cutting of sutures, and the degree of help required, seems to reach a happy medium according to the operator's own particular methods and the nurse's previous training.

Problems of operating room technique, such as standardizing the names of instruments, the elimination of reduplication of effort, and experimentation with new forms of cooperation, have been studied seriously, but need not be elaborated here.